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McDermott, Will & Emery
600 13th Street, N.W.
Washington, DC 20005-3096

EXAMINER	
OLSEN, ALLAN W	
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1792	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/774,417	NISHIBAYASHI ET AL.	
	Examiner	Art Unit	
	Allan Olsen	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claims *1,3,4,12 and 14-18* are pending in the application.

4a) Of the above claims *15* is withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claims *1,3,4,12,14 and 16-18* are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim *15* is subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 May 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09/995,854.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 21, 2008 has been entered. Furthermore, it is noted that the filing of the RCE rendered mute the petition of March 21, 2008 wherein applicants requested the Director to exercise supervisory authority and instruct the Examiner to withdraw the alleged improper finality of the January 9, 2008 Office Action.

Election/Restrictions

Claim 15, newly submitted on claim May 2, 2007 is directed to an invention that is independent or distinct from the invention originally claimed because the originally filed claims are directed to a method of making a diamond product whereas claim 15 is directed to a diamond product that could be made by a different method, For example by fast atom bombardment, laser ablation, or sawing/milling.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 15 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

The Examiner notes that two Office actions have issued since claim 15 was newly added and in both of those Office actions rather than imposing an election by original presentation and withdrawing claim 15, claim 15 was rejected. In those two Office actions the examiner did not restrict claim 15 because the both actions were final actions and the reasserted rejections of record were readily applicable against the newly added claim 15. As such, no additional search was required and the presence of claim 15 posed no additional burden upon the examiner. However, should the prosecution of the pending method claims lead to the claims being deemed allowable, the examiner would need to conduct a new and entirely different search for the product of claim 15. As this would constitute an undue burden upon the examiner claim 15 has been withdrawn.

Drawings

The objection to the drawings is withdrawn. However, as a final point regarding the data in columns 4-6 of Figure 10 (i.e., C/ (total atms) (%); F/ (total atms) (%); and O/ (total atms) (%)), previous exchanges between the examiner and applicant's representative have suggested that the atom percent data in figure 10 were experimentally obtained. However, the atom percent values in figure 10 actually appear to have been derived from simple calculations based upon the CF_4 percentage given in column 2 and it would appear that rounding to one significant digit accounts for the three examples that have a C: F ratio other than the expected 1: 4. (Note that this

would give rise to a 0.03: 0.1 ratio (which normalizes to 1: 3.3) for Example5 rather than the 0.02: 0.1 in figure 10.

For the record, the calculated atom percent values, expressed to the 1/1000th place, for the CF_4 percentages of figure 10 are shown below with the values from Figure 10 as well.

		CALCULATED				FIGURE 10 VALUES		
Sample No.	CF_4/ (CF_4 +O_2) (%)	C/(total atms) (%)	F/(total atms) (%)	C: F		C/(total atms) (%)	F/(total atms) (%)	C: F
Comparative example 1	5	2.326	9.302	1: 4		2	9	1: 4.5
Example1	3	1.435	5.742	1: 4		1	6	1: 6
Example2	2	0.917	3.883	1: 4		1	4	1: 4
Example3	1	0.493	1.970	1: 4		0.5	2	1: 4
Example4	0.1	.050	.200	1: 4		0.05	0.2	1: 4
Example5	0.05	.025	.100	1: 4		0.02	0.1	1: 5
Example6	.02	0.010	0.040	1: 4		0.01	0.04	1: 4
Comparative example 2	0.01	0.005	0.020	1: 4		0.005	0.02	1: 4
Example7	1	0.493	1.970	1: 4		0.5	2	1: 4

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 3, 4 and 12, 14, 16 and 18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

As outlined below, various claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Regarding claims 1, 3, 4, 12, 14 and 16, it is noted that independent claims 1 and 12 each recite "supplying an electric power of less than 1.0 $W/cm^{2"}$. It is further noted that the specification includes two examples wherein a power level of less than 1.0 W/cm^2 is use, with 0.28 W/cm^2 being the lowest disclosed value. However, there is no general disclosure pertaining to the full range encompassed by "less than 1.0 $W/cm^{2"}$. For example, applicant fails to disclose using an electric power within the range of greater than 0 W/cm^2 but less than 0.28 W/cm^2.

Regarding claim 18, applicant's specification does not disclose a process wherein the etching gas contains N_2 and the A/B ratio is not less than 2.5. Figure 5 depicts such a ratio but the data was obtained using an etchant that did not contain N_2. On the other hand, figure 6 depicts the A/B ratio obtained when using an etchant that does contain N_2, however, the A/B ratio never exceeds 2.5 as claim 18 requires.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 17 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 18, it is noted that claim 18 provides two distinct definitions for each of the terms A and B.

Claim 18 recites, in part:

> *"…where A is the intensity of an emission peak at a wavelength of 777 nm and B is the intensity of an emission peak at a wavelength of 558 nm, and…, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen."*

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claim 18 recites the

broad recitation "*where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen*, and the claim also recites *where A is the intensity of an emission peak at a wavelength of 777 nm and B is the intensity of an emission peak at a wavelength of 558 nm* which is the narrower statement of the limitation because molecular and atomic oxygen produce emissions at other wavelength than those recited in claim 18 thereby giving rise to a broader field of possible emission ratios.

Regarding claim 17, it is noted that claim 1 recites:

> *"wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of pure oxygen, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen"*

Assuming that claim 16 is a proper dependent claim, claim 16 further limits claim 1 by reciting:

> *"the mixed gas contains an N_2 concentration that is not less than 2.5% and not more than 40%".*

As such, the amount of N2 defined by the limitation of claim 1 must be broader than the amount of N2 defined by the limitation of claim 16. However, both of these limitations occur in claim 17. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 4 , 12-14 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the paper by Shiomi, "High-Rate Reactive Ion Etching of Diamond and Fabrication of Porous Diamond for Field-Emission Cathode", in New Diamond, Vol. 13, No 4. pp 28-29, in view of US Patent 6,261,726 issued to Brooks et al. and further in view of US Patent 6,013,191 issued to Nasser-Faili et al. (hereinafter, Shiomi, Brooks and Nasser-Faili, respectively).

Shiomi teaches the reactive ion etching of a masked diamond surface. Shiomi teaches the mask comprises aluminum (page 2, line 17 of translation). Shiomi teaches that diamond is etched by a plasma of 100% O_2. Shiomi teaches that the plasma may alternatively comprise NO_2 or N_2. Shiomi teaches that the angle of the sidewall can be controlled by adding CF_4 to the etchant. Shiomi teaches that vertical sidewalls can be obtained by adding a very small amount of CF_4. Shiomi teaches using a CF_4 concentration as low as 0.125% (page 5, line 2).

With respect to independent claims 1 and 12, Shiomi does not teach supplying less than 1.0 W/cm^2 of power to the RIE process. With respect to independent claims 17 and 18, Shiomi does not teach supplying at least 0.45 W/cm^2 of power to the RIE process. Shiomi does not teach using a both O_2 and N_2 in the plasma gas.

Brooks teaches etching diamond with a mixture of O_2 and N_2 (see col 6, line 63).

Nasser-Faili teaches etching diamond within various types of plasma chambers and under a variety of process conditions. Nasser-Faili teaches using a power density of "about 1 W/cm^2" which encompasses the claimed "less than 1.0 W/cm^2" and the claimed "at least 0.45 W/cm^2".

It would have been obvious to one skilled in the art to etch diamond with plasma comprising O_2 and N_2 and a fluorine-containing compound because Shiomi teaches using either O_2 or N_2 and "[i]t is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose."[1] Furthermore, because Shiomi teaches etching diamond with an O_2 plasma while Brooks teaches etching diamond with an O_2/N_2 plasma, a person having ordinary skill in the art would recognize an O_2 plasma and an O_2/N_2 plasma as being are functionally equivalent with respect to the etching of diamond. Furthermore, it would have been obvious to use N_2 in an amount between, the claimed 2.5 % and 40 % because Shiomi teaches that 100% O_2 etches diamond, therefore, one skilled in the art would view N_2 as an additive and would not be expect to use N_2 as the major component over the O_2 etchant. As such, it would be obvious to use less N_2 than O_2 (i.e., between ~1% and 50%).

It would have been obvious to one skilled in the art to add fluorine to the O_2/N_2 mixture of Brooks because Shiomi teaches that the addition of fluorine allows one to gain control over the etching profile. Additionally, in view of Nasser-Faili's teaching, the skilled artisan would have reasonable expectation of success because Nasser-Faili

[1] *In re Kerkhoven* 205 USPQ 1069 (CCPA 1980). Cites *In re Susi* 169 USPQ 423, 426 (CCPA 1971); *In re Crockett* 126 USPQ 186, 188 (CCPA 1960). See also *Ex parte Quadranti* 25 USPQ 2d 1071 (BPAI 1992).

demonstrates the etching of diamond with plasma comprising oxygen, nitrogen and a low fluorine content.

It would have been obvious to one skilled in the art to apply power with a power density of least 0.45 W/cm^2 because Nasser-Faili teaches that by supplying 1.5 W/cm^2 of power, one can obtain vertical structures similar to those obtained taught by Shiomi.

Response to Arguments

Applicant's arguments filed March 21, 2008 have been fully considered but they are not persuasive.

Regarding the rejection under 112 1st paragraph, applicant argues the specification's disclosure of 0.28 W/cm2 and 0.45 W/cm2 provides full support for the claimed "less than 1.0 W/cm2" and that, "the examiner must set forth express findings of fact which support the lack of written description conclusion."

As an express finding of fact, as noted in the above rejection, applicant's specification, including the claims as originally filed, does not disclose using an electric power of less than 0.28 W/cm^2.

Regarding claim 15, now withdrawn, applicant argues:

> *"Shiomi does not teach or suggest an angle of inclination of at least 78 degrees, as required by independent claim 15. Applicants submit that Brooks and Nasser-Faili do not remedy the deficiencies of Shiomi.*

As before, the examiner notes that the transmission electron photomicrographs of Shiomi (figure 5) and Nasser-Faili (figure 1) both depict features having angles of

inclination of at least 78 degrees. Furthermore, the above rejection notes that Shiomi teaches that **vertical** sidewalls can be obtained. As such, at least Shiomi and Nasser–Faili actually anticipate claim 15.

Regarding the rejection under 35 USC 103(a), applicant argues the applied prior art fails to teach the recitation present in each independent claim: "wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of the mixed gas with no nitrogen."

The examiner notes that this condition is met when applicant provided N_2 in an amount between 2.5% and 40 %. Therefore, the applied prior art would likewise be expected to satisfy the emission intensity ratio limitation when using between 2.5 % and 40% N_2.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Allan Olsen/
Primary Examiner, Art Unit 1792